

SY14-15 Grade 8 Math Scope and Sequence

Summary of the Year

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Year-at-a-Glance

Instructional Window 1

- Unit 1.1: Irrational Numbers, Exponents and Radicals

Instructional Window 2

- Unit 2.1: Congruence and Similarity

Instructional Window 3

- Unit 3.1: Linear Equations
- Unit 3.2: Pythagorean Theorem

Instructional Window 4

- Unit 4.1: Functions

Instructional Window 5

- Unit 5.1: Bivariate Data

Fluency and/or Culminating Standards

- 8.EE.7** Students have been working informally with one-variable linear equations since as early as kindergarten. This important line of development culminates in grade 8.
- 8.G.9** When students learn to solve problems involving volumes of cones, cylinders, and spheres - together with their previous grade 7 work with angle measure, area, surface area and volume – they will have acquired a well-developed set of geometry measurement skills.

Grade 8 Overview

THE NUMBER SYSTEM

- ☐ Know that there are numbers that are not rational, and approximate them by rational numbers.

EXPRESSIONS AND EQUATIONS

- Work with radicals and integer exponents.
- Understand the connections between proportional relationships, lines, and linear equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

FUNCTIONS

- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities.

GEOMETRY

- Understand congruence and similarity using physical models, transparencies, or geometry software.
- Understand and apply the Pythagorean Theorem.
- Solve real-world and mathematical problems involving volumes of cylinders, cones and spheres.

STATISTICS

- ☐ Investigate patterns of association in bivariate data.

KEY: ■ Major Clusters | ☐ Supporting Clusters | ○ Additional Clusters

STANDARDS FOR MATHEMATICAL PRACTICE:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

SY14-15 Grade 8 Math Scope and Sequence

| First Instructional Window | Instructional Units | Common Core State Standards for Mathematical Content |
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| <p>August 25 – October 9</p> <p>Suggested Unit Assessment Window: September 29 – October 7</p> | <p>1.1 Irrational Numbers, Radicals, Exponents and Volume Applications</p> <p><i>Approximate number of instructional days:</i></p> | <p>Know that there are numbers that are not rational, and approximate them by rational numbers. <i>(Supporting Cluster Standards)</i></p> <p>8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.</p> <p>8.NS.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). <i>For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.</i></p> <p>Expressions and Equations work with radicals and integer exponents. <i>(Major Cluster Standards)</i></p> <p>8.EE.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.</p> <p>8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.</p> <p>8.EE.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. <i>For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.</i></p> <p>8.EE.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology</p> <p>Solve real-world mathematical problems involving volume of cylinders, cones and spheres. <i>(Additional Cluster Standards)</i></p> <p>8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and</p> |

| | | mathematical problems. |
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| Second Instructional Window | Instructional Units | Standards |
| <p>October 14 – December 12</p> <p>Suggested Unit Assessment Window: November 19 – December 2</p> | <p>2.1 Congruence and Similarity</p> <p><i>Approximate number of instructional days: 20 days</i></p> | <p>Understand congruence and similarity using physical models, transparencies, or geometry software. <i>(Major Cluster Standards)</i></p> <p>8.G.1 Verify experimentally the properties of rotations, reflections, and translations:</p> <ul style="list-style-type: none"> A. Lines are taken to lines, and line segments to line segments of the same length. B. Angles are taken to angles of the same measure. C. Parallel lines are taken to parallel lines. <p>8.G.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.</p> <p>8.G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.</p> <p>8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.</p> <p>8.G.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. <i>For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.</i></p> |
| Third Instructional Window | Instructional Units | Standards |
| <p>December 15 – February 12</p> <p>Suggested Unit</p> | <p>3.1 Linear Equations</p> <p><i>Approximate number of instructional days: 20 days</i></p> | <p>Understand the connections between proportional relationships, lines and linear equations. <i>(Major Cluster Standards)</i></p> <p>8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.</p> |

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| Assessment Window: February 2 – February 10 | | <p>8.EE.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.</p> <p>Analyze and solve linear equations and pairs of simultaneous linear equations. (Major Cluster Standards)</p> <p>8.EE.7 Solve linear equations in one variable</p> <ul style="list-style-type: none"> A. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). B. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. <p>8.EE.8 Analyze and solve pairs of simultaneous linear equations.</p> <ul style="list-style-type: none"> A. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. B. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. <i>For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.</i> C. Solve real-world and mathematical problems leading to two linear equations in two variables. <i>For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.</i> |
| | <p>3.2 Pythagorean Theorem</p> <p><i>Approximate number of instructional days:</i></p> | <p>Understand and apply the Pythagorean Theorem. (Major Cluster Standards)</p> <p>8.G.6 Explain a proof of the Pythagorean Theorem and its converse.</p> <p>8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.</p> <p>8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.</p> |
| Fourth Instructional Window | Instructional Units | Standards |

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| <p>February 17 - April 10</p> <p>Suggested Unit Assessment Window (Optional) March 30 – April 28</p> | <p>4.1 Functions</p> <p><i>Approximate number of instructional days:</i></p> | <p>Define, evaluate and compare functions. (Major Cluster Standards)</p> <p>8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.</p> <p>8.F.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.</i></p> <p>8.F.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. <i>For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.</i></p> <p>Use functions to model relationships between quantities. (Major Cluster Standards)</p> <p>8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.</p> <p>8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.</p> |
| <p>Fifth Instructional Window</p> | <p>Instructional Units</p> | <p>Standards</p> |
| <p>April 20 – June 17</p> <p>Suggested Unit Assessment Window: May 4 – June 12</p> | <p>5.1 Patterns of Association in Bivariate Data</p> <p><i>Approximate number of instructional days: 8 days</i></p> | <p>Investigate patterns of association in bivariate data. (Supporting Cluster Standards)</p> <p>8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.</p> <p>8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.</p> <p>8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. <i>For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.</i></p> |

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| | | <p>8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. <i>For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?</i></p> |
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